Vegetation Resources Inventory

Quality Assurance Procedures for VRI Ground Sampling

Prepared by
Ministry of Sustainable Resource Management
Resource Information Branch
for the Terrestrial Ecosystem Task Force
Resources Information Standards Committee

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The Resources Information Standards Committee evolved from the Resources Inventory Committee which received funding from the Canada-British Columbia Partnership Agreement of Forest Resource Development (FRDA II), the Corporate Resource Inventory Initiative (CRII) and by Forest Renewal BC (FRBC), and addressed concerns of the 1991 Forest Resources Commission.

For further information about the Resources Information Standards Committee, please access the RISC website at: http://srmwww.gov.bc.ca/risc/.

Major Amendments

March 04 : Contract agreements between the Ministry of Forests, the Ministry of Sustainable Resource Management and Price Waterhouse Coopers require that all 3rd party ground sample inventory quality assurance reports must be sent to the VRI forester in the new MSRM service or contact centers. For more information on who to contact, please see the following web site: http://srmwww.gov.bc.ca/tib/vri/vri/contactinfo.html.

March 03: The procedures have been modified to reduce the amount of time required to complete an audit.

Compilation of value and volume is now optional. Final pass/fail decisions can be made without the compiled information.

A pass/fail point system for selected attributes has been established in addition to the critical pass/fail standards.

A defined list of timber attributes to check rather than a full or partial audit.

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Ground Sampling Quality Assurance Procedures

Introduction

The Vegetation Resources Inventory (VRI) uses a two-phase sampling system to describe trees and other vegetation. The first phase (photo interpretation) involves the delineation of polygon boundaries and the estimation of a variety of vegetation polygon attributes from aerial photographs. The second phase (ground sampling) involves measurement of a variety of vegetation attributes at randomly selected ground sampling points within the Phase I polygons. A quality assurance audit is performed concurrently with the Phase II sampling.

Two monitoring/checking processes are used to ensure that quality field measurements are being collected in the ground sampling phase:

Quality Assurance is an external process, whereby the work is evaluated based on approved standards by an independent auditor and rated as having passed or failed. The auditor must be certified in VRI Ground Sampling Timber or Ecology depending on the data that is to be audited. The auditor must also be an experienced individual capable of conducting quality measurements and assessments to ensure the ground sampling procedures have been conducted within standards. There should be an arm's length relationship between the Quality Assurance auditor and the project being evaluated.

Quality Control is an internal process, whereby the project manager ensures that the fieldwork is being done to the required standards in accordance with the procedures. This is the opportunity for the project manager to provide additional training to field crews.

The procedures described here are the quality assurance procedures developed by the Ministry of Sustainable Resource Management (MSRM) to be implemented on all VRI ground sampling projects. It is expected that field sampling crews will have their own quality control procedures.

The objectives of the audit are to:

- provide feedback to improve sample quality
- provide information for contract administration.

The auditor identifies substandard sampling work and provides feedback to improve the crews' performance. Another important aspect of the auditor's work is to provide positive feedback to sampling crews on a task well done.

An important issue for contract managers is whether the completed work is acceptable. Several levels of standards have been established for the data collection.

- Pass/fail standards have been established for critical attributes.
- Optional pass/fail standards have also been established for the compiled gross and net volumes.
- Pass/fail point standards have also been established for specific attributes.

- Standards have also been established for supporting information that contributes to the location, establishment, and measurement of samples.

If the audit shows a batch does not meet these standards, the batch fails and the samples must be revisited.

A separate document, *Data Collection Standards for VRI Ground Sampling*, provides the standards of accuracy for VRI attributes measured from ground samples. A standard is a maximum allowable error for a given attribute. The standards are based on levels of precision achievable by auditors and were developed in consultation with a group of auditors in the various fields.

It is intended that quality assurance audits will be carried out as soon as possible after the samples are completed.

In order for the MSRM to ensure the data meets current standards, all copies of 3rd party quality assurance reports must be sent to the MSRM VRI forester in the newly formed contact or service centers. For more information on who to contact, please see the following web site: http://srmwww.gov.bc.ca/tib/vri/vri/contactinfo.html

The flowchart in Figure 1 provides an overview of the ground sampling and audit process for the VRI.

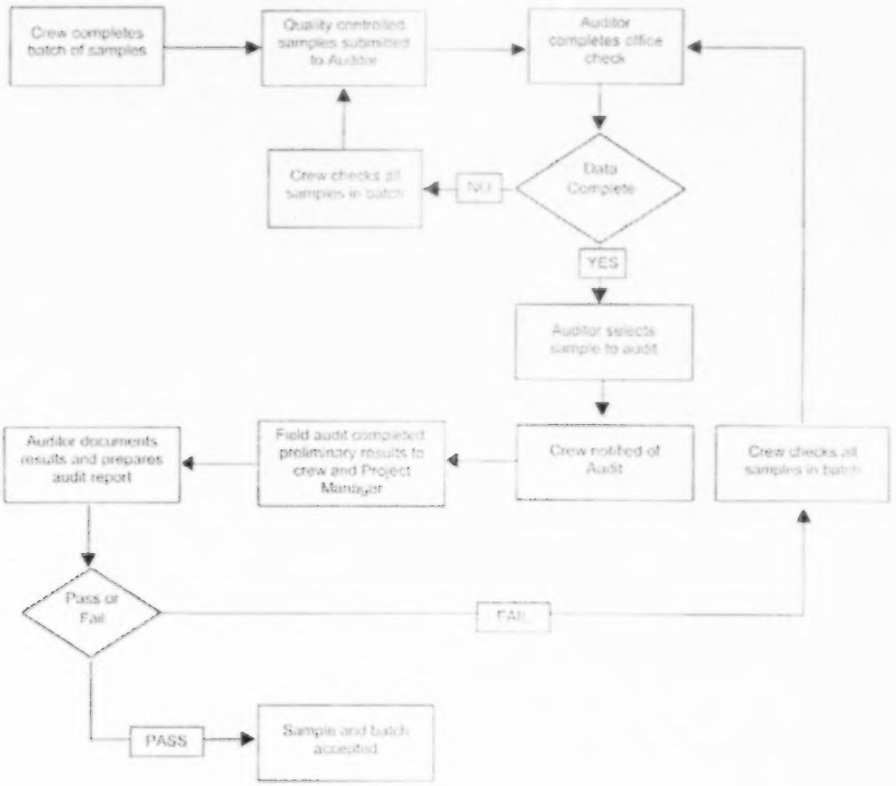
Crew completes batch of samples
Quality controlled samples submitted to Auditor
Auditor completes office check
Crew checks all samples in batch
NO
Data Complete
YES
Auditor selects sample to audit
Auditor documents results and prepares audit report
Field audit completed preliminary results to crew and Project Manager
Crew notified of Audit
Crew checks all samples in batch
Pass or Fail
FAIL
PASS
Sample and batch accepted

Figure 1. Flowchart of the ground sampling and audit process.

Objectives

The audit process has two main objectives:

- to provide feedback to improve sample quality
- to provide information for contract administration.

Feedback

Feedback from the audits is important for the continual improvement in sample establishment. The auditor will note any problems found in the audits so that the field crews will be aware of areas where they may require improvement. Positive feedback is also valuable in improving sample measurements. To successfully accomplish this objective the crews should be audited early in the project and subsequent batches should be audited as soon as possible after they are submitted. The field crews will benefit from accompanying the auditor in the field and are encouraged to attend, especially on the initial audits

Contract Administration

The audit provides the contract administrator with information about the quality of the work being completed. Standards have been established for the location and measurement of samples. Contract administrators will use the pass/fail criteria as the basis for payment.

Audit Principles

Plot Selection

An audit system requires a statistically valid sample of ground samples. For the sample to be valid, four criteria must be met:

1. Batches of samples must be established. The criteria for defining a batch will be determined at the pre-work conference.
2. Audit samples must be chosen randomly within each batch except in specific "abnormal" circumstances as described in the detailed procedures.
3. The selection probability (i.e., number of audit samples divided by total number of samples) must be known and recorded.
4. The list of samples included in a batch must be recorded.

It is recommended that a minimum of 10% of all samples should be audited and that auditing be more frequent at the beginning of the project.

Sample Batches

The exact batch size and composition of the batch will vary for each project and will be discussed at the pre-work conference.

To ensure early detection of potential errors the initial batch(s) should be small (3-5 samples) and should be separated by crew leader. Future batch sizes and the composition of each (for

example, crew leader or company, low volume or high volume samples, immature versus mature) will be based on the outcome of the initial audits.

Pass/Fail Standards

Pass/fail standards have been established to ensure that the work meets minimum standards. These pass/fail standards are outlined in the *Data Collection Standards for VRI Ground Sampling*.

Batch Submission Requirements

It is expected that all submitted batches will be complete as set out in the pre-work conference. This includes requirements for air photos, maps, field cards and any other project specific information. The field cards for all samples in the batch must be complete before the auditor will field audit any sample in the batch. All samples in the batch will be returned if the batch is not complete when submitted.

General Procedures

1. Select the samples to audit.
2. Perform office checking.
3. Perform field audit.
4. Prepare audit summary.

Detailed Procedures

The following is a suggested process to follow:

Selecting Sample Plots to Be Audited

1. Determine the batch to be audited.
2. Randomly select the sample(s) to audit from the batch and document the selection. If "abnormal" weather, safety or access restrictions do not allow the sample to be audited, another audit sample may be randomly selected to satisfy contract administration requirements. Any time an audit sample is replaced the reasons must be documented.
3. A list of all the samples in each batch, the samples audited, dates audits were completed, and results of audits must be maintained. An example of an auditor's list is found in Appendix 1.
4. It is also suggested that documentation around the random selection of audit samples be maintained as well. An example of such documentation is found in Appendix 2.

Office Checking

Complete an office evaluation of all samples in the batch. If any of the samples are incomplete or errors are noted, all samples will be returned and the audit will take place when the completed batch is returned. All corrections or additions to the field cards, after the field crew has left the field, must be done in **red** ink on the original cards.

Notify the field crew and project manager that an audit will take place. It is recommended that the original field crew accompany the auditor, especially in the early phase of the project.

Field Audit

Perform a field audit of the selected samples. Complete a "blind" audit of the field data without checking the original field cards. The auditor will have to review the basic plot size data and plot procedures used but must not review the actual collected data.

After collecting the audit data, crosscheck the original plot data in the field to validate similar data and assess measurement differences.

- No changes are to be made to the original field data cards at this time. If minor errors or data omissions have been identified that must be corrected, to enable the data to be processed, the entries will be entered in **red** ink on the original field cards. The project manager decides who will enter the data.
- Document the major discrepancies in the comments section on one of the audit field cards before leaving the sample

The preliminary audit results should be presented to the field crew and project manager as soon as practical following the audit.

All plots in the cluster must still be visited, however not all of the attributes will be measured in the audit. Key attributes have been identified that must be measured in all samples, while others have been identified to be measured on only a selected number of trees. The following is a list of attributes that must be checked during a standard audit. A complete audit of all attributes on any selected audit sample can also be done if the project manager decides it is necessary and is advisable at the start of a new project or with a new crew.

Audit for Timber Attributes

1. Check IPC pin location in the polygon
2. Measure distance and bearing from Reference pin to IPC pin
3. Measure all trees within the cluster for in/out confirmation
4. Check all trees within the cluster for tree genus and species
5. Check all trees within the cluster for live/dead status
6. Randomly select 5 measured trees within the plot cluster from the IPC and the enhanced auxiliary plot trees. Check the following attributes on these trees:
   - standing / fallen
   - DBH
   - length
   - crown class
   - first log grade
   - first log length
   - second log grade
   - second log length
   - broken top diameters
   - projected heights
   - damage agents
   - loss indicators
7. Check site tree selection on all plot locations

8. Check all site trees for the following attributes:
   - Tree length
   - DBH
   - Field bored age
   - pro-rate core lengths (if applicable)
9. Check the small tree plot for tree species identification and total tree count.
10. All other attributes should be evaluated to make sure they are within accepted standards. This is especially important at the beginning of a project or with a new crew. If this is not good enough for wording then give me some specific suggestions.

Audit for Ecological Attributes

1. Coarse Woody Debris
   - Randomly select one transect
   - For round pieces collect species, diameter and decay class for the piece.
   - For accumulations and/or odd shaped pieces, collect species, horizontal length and vertical depth on transect, and decay class for the piece.
2. Range
   - Use the same transect as randomly selected for the CWD.
   - Measure all values for the one transect.
3. Ecological description [EP]
   - Collect the following attributes [1] Uniformity, [2] Biogeoclimatic unit, [3] Site series and coverage, [4] SMR, [5] SNR, [6] Land cover classification, [7] Slope, [8] Aspect, [9] Elevation, [10] Surface shape, and [11] Meso slope. Collect 7 to 11 on card ED if required.
4. Tree and shrub layers [ET]
   - Collect the data as usual, excluding average height values, for all species with ≥ 1 % coverage. Do overall cover estimate for the A, B1 and B2 layers.
5. Herb and moss layers [EH]
   - Collect data as usual for those species with ≥ 1 % coverage. Do the overall % cover estimate for the C, and applicable D layers.
6. Succession interpretations [EO]
   - Collect all attributes as usual excluding attribute 29 (tree succession species).

Preparing the Audit Summary

1. Complete a summary report for each audit sample. Summary reports will vary by project and the format will be determined at the pre-work conference.
2. If necessary, compile the audit sample to determine whether the data meets the established pass/fail criteria. If the pass/fail criteria are not met, the sample fails. In this case the "batch" of work will fail and the crew will be instructed to revisit, at their own cost, all samples in the batch to correct the items identified as contributing to the rejection. The batch of samples will then be subjected to an additional audit.
3. Provide feedback to the field crews and project manager about any items that may need work.
4. The project manager will be advised in "writing" of the samples that comprised the batch, which sample was selected for audit, and the results of the audit. The audit summary will be attached for reference.

5. A copy of the audit report is to be sent to the VRI forester in the MSRM service or contact centre.

Appendix 1: Auditor's List

Vegetation Resources Inventory

Project Jones Creek

Sampling Crew Leader Bob Johnson **Ecological Attributes** ☐

Random Order	Plot Cluster No.	Date Sample Completed	Audit Batch	Date Audited	Pass / Fail	Comments
1	27	May12	1			
2	23	May 13	1	May21	Pass	
3	7	May15	1			
4	13	May16	2			
5	17	May17	2	May 26	Fail	
6	11	May18	2			
7	3	May19	2			
8	15	May20	2			
9	19	May23	3			
10	8	May24	3			
11	20	May25	3			
12	4	May26	3	June1	Pass	
13	13	May28	2			Re-audit
14	17	May28	2			Re-audit
15	11	May29	2	June1	Pass	Re-audit
16	3	May29	2			Re-audit
17	15	May30	2			Re-audit
18	47	June1	4			
19	54	June2	4			
20	12	June3	4			
21	46	June4	4			
22	5	June7	4			
23	1	June8	4			
24	16	June9	4			
25	25	June10	4	June12	Pass	
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						

Note: Appendices 1-5 are available as "template" documents through the Terrestrial Information Branch website.

Appendix 2: Audit Plot Selection List

Project: Jones Creek

Random Order	Sample Number
1	27
2	23
3	7
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Crew Leader Bob Johnson

Batch # 1

Random # selected 2

Date May 17, 2001

Auditor J. Smith

Ecology ☐

Trees ☑

Random Order	Sample Number
1	13
2	17
3	3
4	15
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Crew Leader Bob Johnson

Batch # 2

Random # selected 2

Date May 23, 2001

Auditor J. Smith

Ecology ☑

Trees ☑